UNIVERSITI TEKNOLOGI MARA

ENZYMATIC HYDROLYSIS AND MODELLING OF FERMENTABLE SUGAR PRODUCTION FROM KITCHEN WASTE

SHARIFAH IZIUNA BT SAYED JAMALUDIN

Thesis submitted in fulfilment
of the requirements for the degree of
Masters of Science

Faculty of Chemical Engineering

April 2014

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of student	: Sharifah Iziuna Bt Sayed Jamaludin
Student's ID No.	: 2010469626
Programme	: Master of Science (EH 780)
Faculty	: Chemical Engineering
Thesis Title	: Enzymatic Hydrolysis and Modelling of Fermentable Sugar Production from Kitchen Waste
Signature of Candidate	: 
Date	: April 2014

ABSTRACT

This study focused on maximizing the amount of reducing sugar produced from enzymatic hydrolysis of kitchen waste catalyzed by cellulase from *Trichoderma viride* and *Trichoderma reesei*, which was used separately to compare the results obtained from each enzyme. Effects of enzyme dosage (X_1), substrate concentration (X_2), hydrolysis time (X_3) and temperature (X_4) were evaluated by Full Factorial Design (FFD) to determine the significant parameters affecting the production of reducing sugar. Optimization of process conditions were also performed using Central Composite Design (CCD) within the range employed for each independent variable. All the variables evaluated using FFD was found to have a significant effect towards the production of reducing sugar. The study has shown that enzymatic hydrolysis catalyzed by cellulase from *T.viride* is efficient in producing high amount of reducing sugar. A modelling study on enzymatic hydrolysis of kitchen waste was also performed to predict the reducing sugar yield using the datasets obtained from Response Surface Methodology (RSM) studies. A multi-layer feed-forward back-propagation artificial neural network (ANN) models were developed for enzymatic hydrolysis with input variables chosen from RSM studies. A comparative observation between ANN model and RSM model was also performed. Based on the R^2 (correlation coefficient) and MSE (mean square error) values, it was concluded that ANN model is more accurate in predicting the reducing sugar yield than RSM model.

ACKNOWLEDGEMENTS

"In The Name of Allah Almighty and the Most Merciful and Blessings Be Upon His Messenger Prophet Muhammad s.a.w. and His Companions"

Bismillahirrahmanirrahim,

I am thankful to Allah s.w.t. and the Almighty for His divine inspirational guidance, which had helped me in completing my Masters. I wish to express my deepest gratitude to my research supervisor, Prof. Dr. Sharifah Aishah Syed Abd. Kadir, for her constructive guidance, encouragement and support during fulfilling this research.

I would like to convey my sincere thanks to Dr.Jagannathan Krishnan, my co-supervisor who has enriched me not only in technical aspects but also for his keen assistance and unreserved advice.

I highly appreciate the continuous assistance from the FKK Laboratory staffs, En. Mohd Ridhuan Salleh, Pn. Azizan, Pn. Rohaida, Pn. Roswati, Cik Hajar, Pn. Khuzairin, En.Yaziz, Pn. Baizura for assisting me throughout my experimental works. Thank you to my postgraduate's colleagues, for their kind support throughout my graduate studies. You all have touched my life in your own unique way. I am also thankful to the rest of the Faculty of Chemical Engineering lecturers and staff.

I would not have met this goal, if it wasn't for the love and support of my family and friends. I am extremely thankful for the encouragement and unlimited moral and material support given by my parents, En. Sayed Jamaludin and Pn. Nik Rohaya, my sisters, Sharifah Izyani, Sharifah Izzati and Sharifah Athilah and my brothers, Syed Izhar, Syed Izhan and Sayed Mohammad Fatih. They have seen me at my best and my worst, but throughout they have always believed in me.

Finally, I am thankful to KPT for providing the financial support for this research study through FRGS and to UiTM for providing me the scholarship under the Young Lecturer Scheme during my study. To the people who had contributed to my Master's research directly or indirectly, my appreciation goes to you.

TABLE OF CONTENTS